Price $2.00

MULTI-ELMAC

Amateur Receiver

MODEL PMR 7
& ACCESSORIES

INSTALLATION
AND
OPERATING INSTRUCTION
MANUAL

MULTI-PRODUCTS CO. **OAK PARK, MICH.**

Manufacturers of ***"MULTI-ELMAC"*** *Products*

MULTI-PRODUCTS COMPANY

Manufacturer of

MULTI-ELMAC

RADIO COMMUNICATIONS

AND CONTROL EQUIPMENT

21470 COOLIDGE HIGHWAY OAK PARK 37, MICH.

FORM NO M121

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SECTION 1

Description

1.1 GENERAL. The MULTI-ELMAC PMR-7 RADIO RECEIVER is a ten tube double conversion superheterodyne covering the 160, 80, 40, 20, 15, and 10 meter amateur bands, plus the standard broadcast band. Designed primarily as an efficient communications receiver for mobile use, it is also especially suitable, because of its small size, for (1) marine and aircraft installations; (2) portable operation; and (3) as a fixed station or monitoring receiver. It is not intended as a converter or accessory to another unit, but a complete receiver, employing a separate power supply and speaker as described in this manual. Every effort has been made to furnish the user with an extremely stable receiver of rugged construction, compact layout, and high sensitivity.

1.2 DIMENSIONS. The maximum external dimensions of the PMR-7 receiver, including the control knobs are: height, 4⅝", width, 7", and depth, 11½". The depth behind the panel is 9⅞". The net weight of the receiver is 8½ pounds.

1.3 CIRCUIT DESCRIPTION. The circuit consists of one stage of radio frequency amplification, a first mixer and stabilized local oscillator. The output frequency of the first mixer is 2238 kc. and there is one stage of amplification at this frequency. The second mixer and crystal controlled oscillator are combined into a single dual purpose tube. The output frequency of the second mixer is 262 kc. and there is one stage of amplification at this frequency. The detector, delayed A.V.C. and A.N.L. are combined into a single triple diode tube. The first audio amplifier and squelch control are combined into a dual purpose tube. The audio output is a beam power amplifier supplying sufficient audio output for speaker and headphone operation. The layout diagram of the receiver may be seen in figure 1.

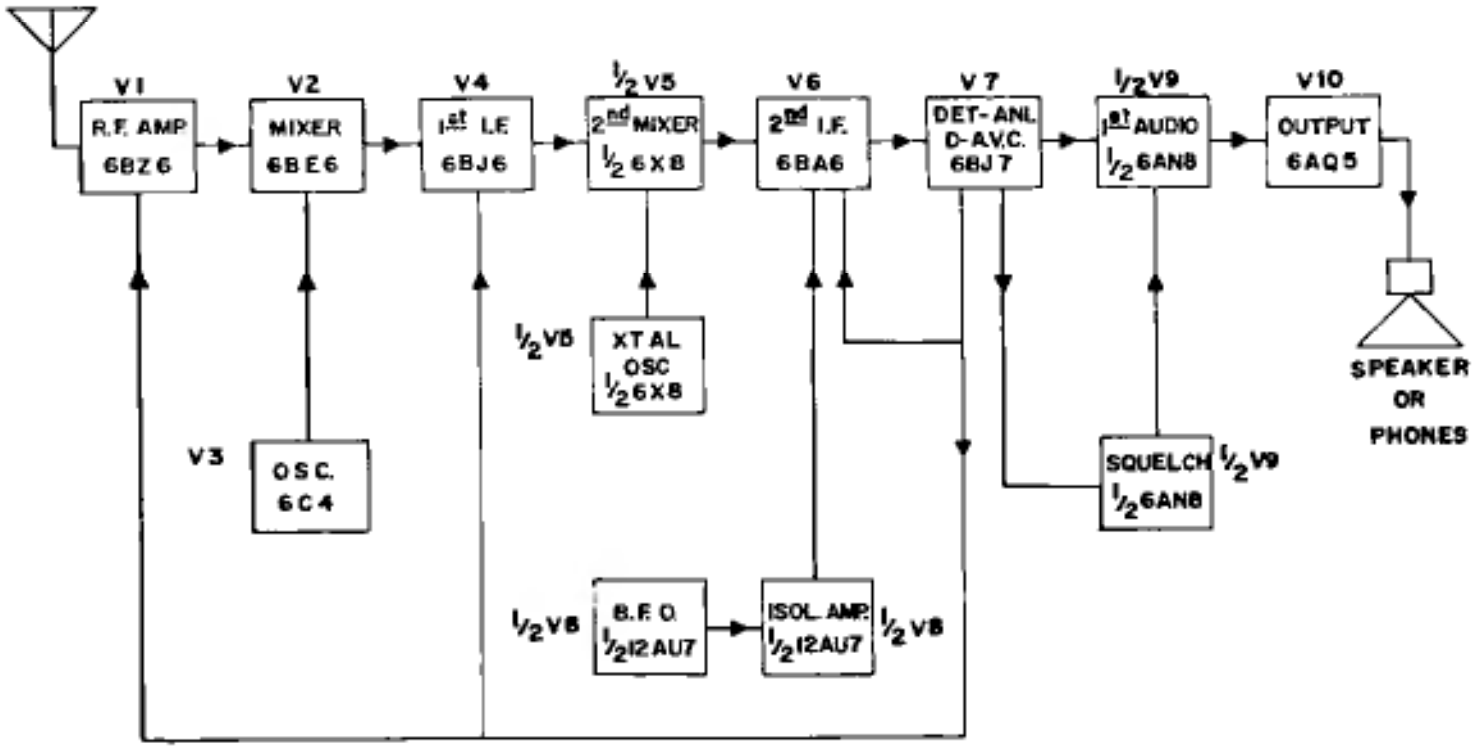
High sensitivity and a good noise figure has been obtained by the use of a high gain R.F. amplifier and special R.F. coil design. The good noise figure is obtainable by designing the front end coils for optimum Q and minimum noise transfer. Since the primary noise characteristics of a receiver are determined in the R.F. coils, care in their design has resulted in an excellent signal to noise ratio and noise figure. A secondary consideration in determining the noise figure of a receiver is the selection of the last I.F. frequency. The noise passed by an I.F. amplifier is proportional to the bandpass of the amplifier. 262 kc. was chosen for good selectivity characteristics and pursuant noise reduction. The selectivity characteristics for the PMR-7 may be seen in figure 2.

The overall drift in the receiver has been kept to a minimum by the use of temperature compensating capacitors in the local oscillator and a crystal controlled second converter. Rigid mechanical construction also adds to the general stability of the unit.

The squelch circuit incorporated in the PMR-7 enables the receiver to be automatically silenced when no signal is being received. The squelch tube functions to cut off the audio amplifier when no A.V.C. voltage is developed. The threshold for the squelch can be controlled from the front panel for varying conditions of noise. If the control is adjusted just above the threshold, that is to just squelch the receiver, an increase in signal of .5 microvolt will open the squelch circuit.

Delayed A.V.C. is used in this receiver to provide maximum sensitivity with the use of A.V.C.. In ordinary Automatic Volume Control circuits, inherent noise in the receiver will produce some bias voltage. This bias voltage when applied to the amplifiers will reduce the sensitivity of a receiver. A system employing delayed A.V.C. prevents this bias from being applied to the amplifiers until the input signal is in excess of 8 volts at the A.V.C. rectifier diode.

The B.F.O. in the receiver injects 262 kc. energy into the output I.F. amplifier through an isolation amplifier. Both the pitch and the amount of injection are adjustable from the front panel. The purpose of the isolation amplifier is to prevent the B.F.O. from locking in with the signal present at the I.F. amplifier and to allow variation of the injection voltage without varying the B.F.O. frequency. Variable pitch and injection are a "must" when receiving C.W. and S.S.B. signals.



PMR-7 BLOCK DIAGRAM FIGURE 1

1.4 TUBE COMPLEMENT. The PMR-7 is supplied complete with all tubes tested in the receiver at the time of alignment. The tube types are as follows:

R.F. Amplifier	6BZ6
First Mixer	6BE6
H. F. Oscillator	6C4
First I.F. Amplifier	6BJ6
Second Mixer	6X8
Second I.F. Amplifier	6BA6
Det., A.V.C., A.N.L.	6BJ7
First Audio and Squelch	6AN8
B.F.O. and Amplifier	12AU7
Audio Output	6AQ5

1.5 TUNING SYSTEM. A three-gang tuning capacitor and 21 high-Q coils are used to cover the 7 separate bands selected by a panel switch, as follows:

Band 1 10 meters	28.0 to 29.7 Mc
Band 2 15 meters	21.0 to 21.45 Mc
Band 3 20 meters	14.0 to 14.40 Mc
Band 4 40 meters	7.0 to 7.30 Mc
Band 5 80 meters	3.5 to 4.0 Mc
Band 6 160 meters	1.8 to 2.0 Mc
Band 7 Broadcast band	.54 to 1.6 Mc

1.6 ANTENNA INPUT. The receiver is designed for use with a resonant antenna coupled to the receiver input with a transmission line of 50 to 72 ohms impedance. Detailed installation recommendations are contained in paragraph 2.3.

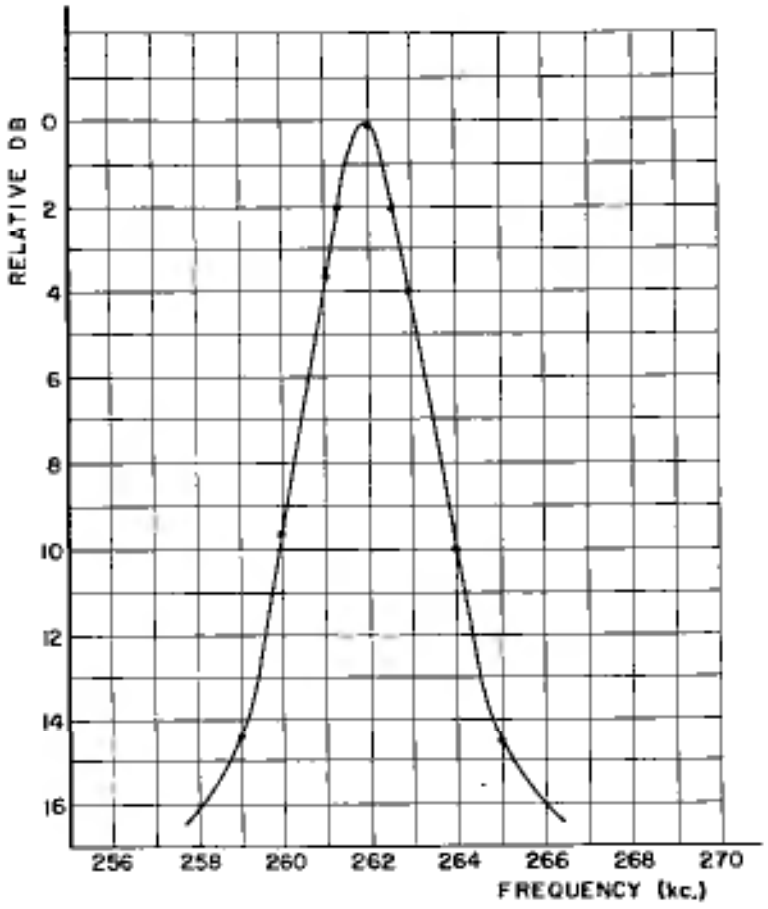
1.7 AUDIO OUTPUT. An output transformer matching the output tube to a permanent magnet dynamic speaker having a voice coil impedance of 3 to 6 ohms is included on the receiver chassis. The speaker leads terminate at the accessory plug on the A.C. power supply. Also included on the rear of the receiver chassis is a headphone jack that disables the speaker when the headphones are in use.

1.8 POWER SUPPLIES AND ACCESSORIES. The following power supplies are available for use with the MULTI-ELMAC PMR-7 receiver.

The PSR-117 Power supply, for 117 volts A.C. 50-60 cycle operation, supplies the necessary plate and filament voltages for the receiver and can be used to power the low level stages of a companion transmitter. The power supply has an "S" meter and adjusting potentiometer included.

The PSR-612 Power supply is for either 6 or 12 volt operation. It is the same as the PSR-117 without the "S" meter. Both 6 and 12 volt operation will be discussed in the section under installation.

The ESS-3 is a 2 inch "S" meter mounted in a metal box suitable for mobile operation. It is supplied with a cable and plug and may be used in conjunction with the accessory plug on the PSR-612.
The above power supplies contain an accessory plug that may be used to supply companion units or accessory kits for the receiver.



PMR-7 SELECTIVITY CURVE

FIGURE 2

SECTION 2

Installation and Operation

2.1 GENERAL CONSIDERATIONS. No two installations being alike, the owner of a MULTI-ELMAC PMR-7 receiver will vary his installation according to the space available, and the individual operator's desires in regard to operating practices. Regardless of these variations, whenever the receiver is installed in a vehicle, there are three essentials to a proper installation; (1) Convenient location for operation, including ease of observation; (2) Rigid mechanical mounting, and (3) elimination of radio noise. The amateur experienced in mobile radio work will have his own preferences. It is suggested that before installation is begun, the owner read the very thorough treatment given to mobile installations in the past issues of QST and CQ magazines.

2.2 MOUNTING METHODS. The light weight of the PMR-7 makes it readily adaptable to a hanging mount from the lower edge of the dashboard. A length of aluminum angle stock from the rear corner of the receiver cabinet to the fire wall of the vehicle will complete a simple but rigid mount. If the individual wishes to spend the extra time and money and the car dashboard has sufficient space, a very neat installation can be effected by making the proper cut-out into the instrument panel and mounting the receiver flush. This method is suitable where the panel contains a removable metal grille which can be replaced if the receiver is removed. Due to the great number of variations encountered in mounting methods no brackets are included. Most amateurs have enough surplus angles to fashion a bracket that would serve their particular needs better than any universal bracket that could be supplied.

2.3 ANTENNA. The MULTI-ELMAC PMR-7 receiver will perform most efficiently when it is coupled to an antenna resonant on the frequency band to which the receiver is tuned. As in the operation of a fixed amateur station, this condition is most easily obtained by using the same antenna for both transmitting and receiving. A change-over relay operated by the push-to-talk switch on the microphone is required, and may be installed between the receiver and transmitter with a common coaxial line to the antenna. See Figure 6 for a typical circuit.

2.4 POWER SUPPLY. The MULTI-ELMAC PMR-7 receiver requires a filament voltage of 6.3 or 12.6 volts at 3.6 or 1.8 amperes respectively, and a "B" supply voltage of 250 volts at 60 Ma. and 105 volts regulated at 10 Ma. This latter voltage may be derived from the 250 volt supply. The power supply may be located anywhere in the vehicle providing the hot lead (either 6 or 12 volts) is heavy enough to furnish the necessary current without undue voltage drop. Make sure that the case of the power supply is efficiently grounded to the car body. If this cannot be done with the mounting bolts, a heavy copper braid ground strap must be provided. This insures sufficient voltage to the power supply and also eliminates the possibility of the receiver picking up vibrator hash noise. The power supply can be bolted to the fire wall either in the car or under the hood.

The D.C. power supply may be operated on either 6 or 12 volts by merely changing a plug that can be seen if the top cover of the power supply is removed. This plug changes the filaments in the receiver and makes the proper modifications in the power supply.

2.5 "S" METER. Provision has been made for the attachment of an external "S" meter giving relative signal strength readings. This meter is available in the form of a kit that can be mounted in any convenient place in the vehicle and connected to the accessory plug located on the power supply.

2.6 CONTROL CIRCUITS. While this manual does not include within its scope general instructions on control systems for mobile installations, it is important for the user of the PMR-7 receiver to employ control circuits that will (a) protect the receiver from R.F. overload by disabling it during periods of transmission, (b) make the transmitter instantly inoperative when the send-receive switch is released, and (c) achieve a maximum economy of battery drain. A small single-pole double-throw relay, when using a MULTI-ELMAC power supply, will mute the receiver instantly when the send-receive switch is operated. A typical system of this type may be seen in Figure 5.

2.7 RECEIVER CONTROLS. The MULTI-ELMAC PMR-7 has eight controls and two switches on the front panel. Figure 4 shows the front view of the receiver and the control layout.

Control "A"—Concentric control.

1. Center, Squelch and A.V.C. on-off switch.
2. Outside, B.F.O. injection

Control "B"—Bandswitch.

Control "C"—Antenna trimmer. Peak for each band.

Control "D"—Concentric control.

1. Center, Audio gain and power on-off switch.
2. Outside, R.F. gain control.

Control "E"—Tuning knob.

Control "F"—B.F.O. Pitch control.

Switch "G" —A.N.L. on-off switch.

Switch "H" —B.F.O. on-off switch.

2.8 VEHICULAR NOISE SUPPRESSION. The proper utilization in a mobile installation of a good communications receiver such as the MULTI-ELMAC PMR-7 is possible only when vehicular noise has been effectively eliminated or suppressed. Many radio noises present in a vehicle can be eliminated at their source. Most other noises of local origin can be suppressed, using techniques well described in current litereture. After efficient noise suppression has been employed, it will be found that the automatic noise limiter built into the MULTI-ELMAC PMR-7 receiver will reduce all but the worst noise pulses to a level which will not interfere with satisfactory radio communication. It is particularly recommended that the following noise suppression be accomplished.

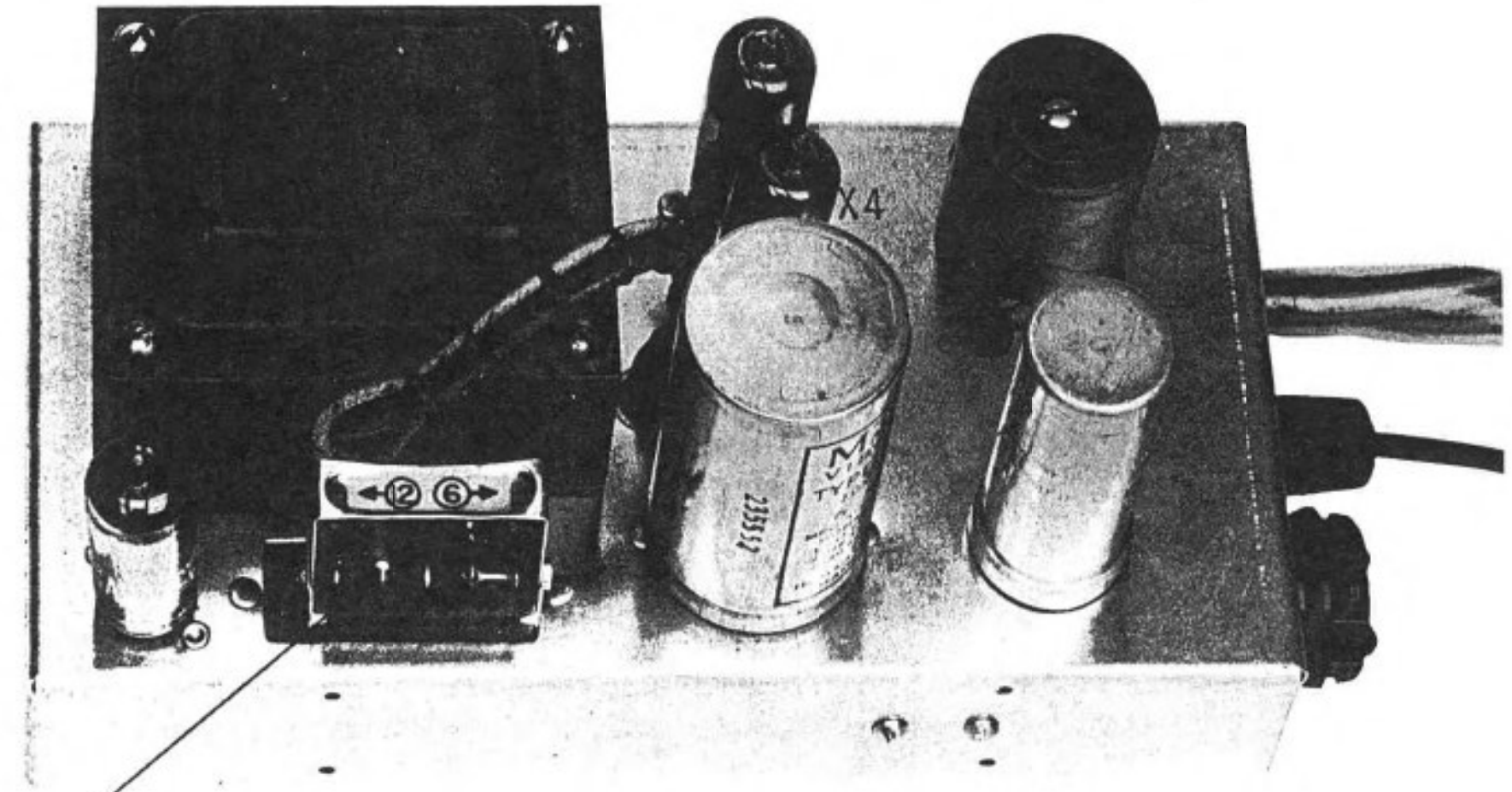
(1) The installation of spark plugs containing built-in 10,000 ohm suppressors or 10,000 ohm suppressors mounted on each plug.

(2) The installation of a .1 mfd coaxial capacitor in series with the battery lead to the ignition coil. This should be mounted as close as possible to the coil input terminal, and a good ground made to the capacitor case.

(3) The installation of a .1 mfd coaxial capacitor in the "hot" lead coming out of the vehicle generator armature, replacing the normal automotive unit. The capacitor should be carefully grounded to the generator fraine. All paint and dirt should be cleaned off with sandpaper.

(4) The installation of a .1 mfd coaxial capacitor between the battery terminal of the voltage regulator and ground, with the capacitor case well grounded as before. The installation of a .002 mfd mica capacitor in series with a four (4) ohm carbon resistor from the field terminal of the voltage regulator to ground.

(5) Residual noise remaining after the above precautions have been taken can be located by the process of elimination. In certain makes of automobiles, the various panel instruments radiate interference at radio frequencies which can be eliminated with appropriate by-pass capacitors from the "hot" side of the offending instrument to ground.



6 VOLT-12 VOLT CONVERSION PLUG. SHOWN IN 6 VOLT POSITION, MOVE TO LEFT FOR 12 VOLT OPERATION.

FIG.3 PSR 612

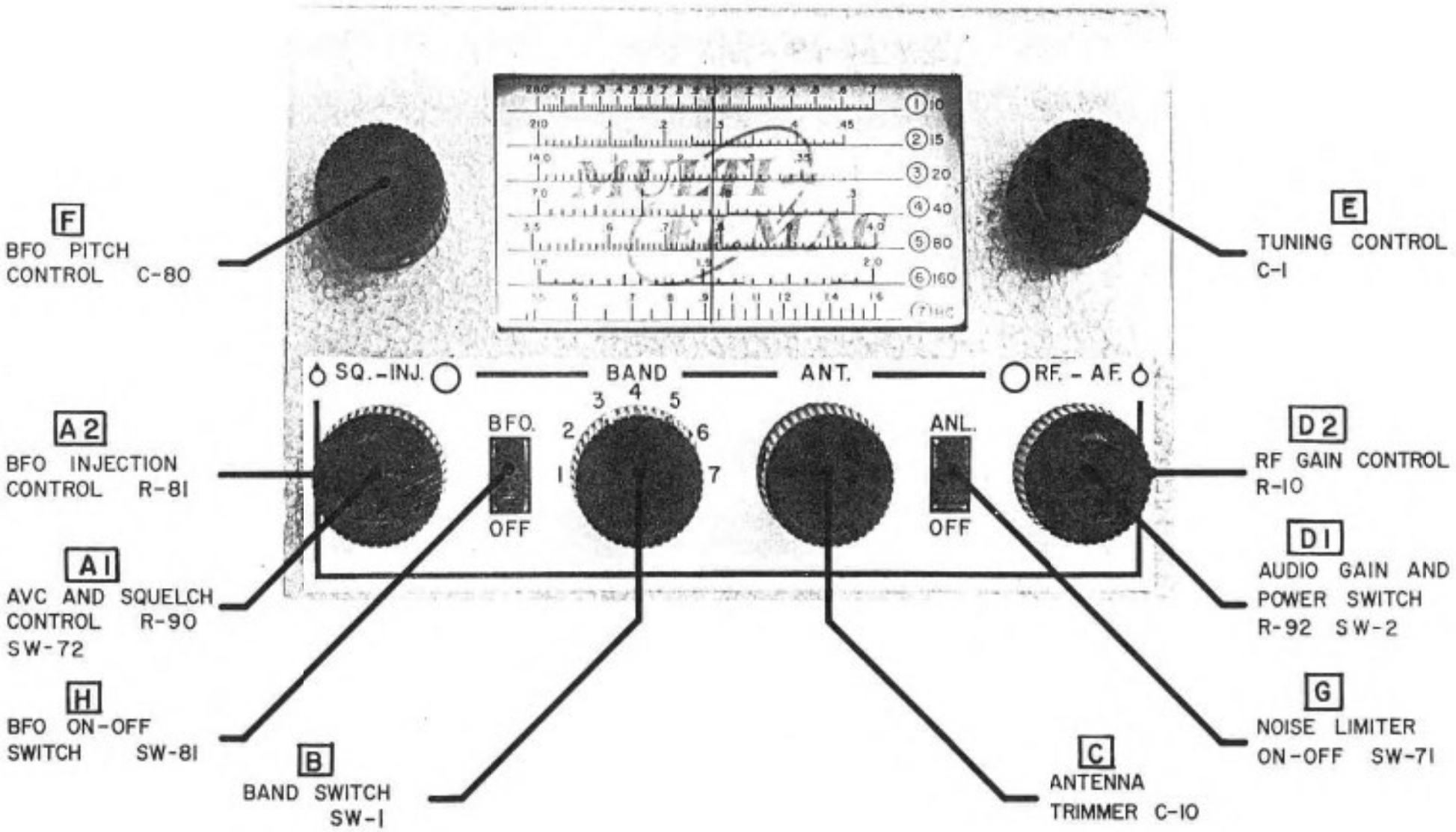


FIGURE 4. PMR-7 FRONT PANEL CONTROL LAYOUT

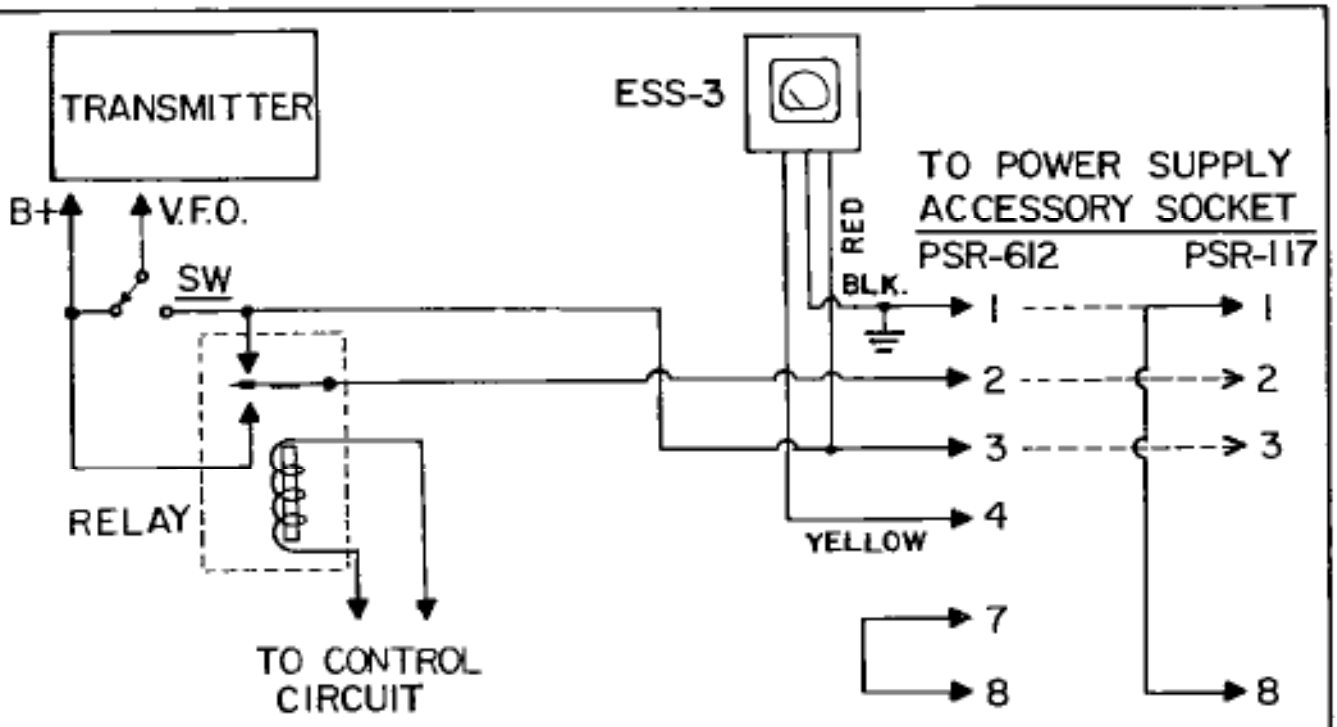


FIG.5 ACCESSORY SOCKET WIRING

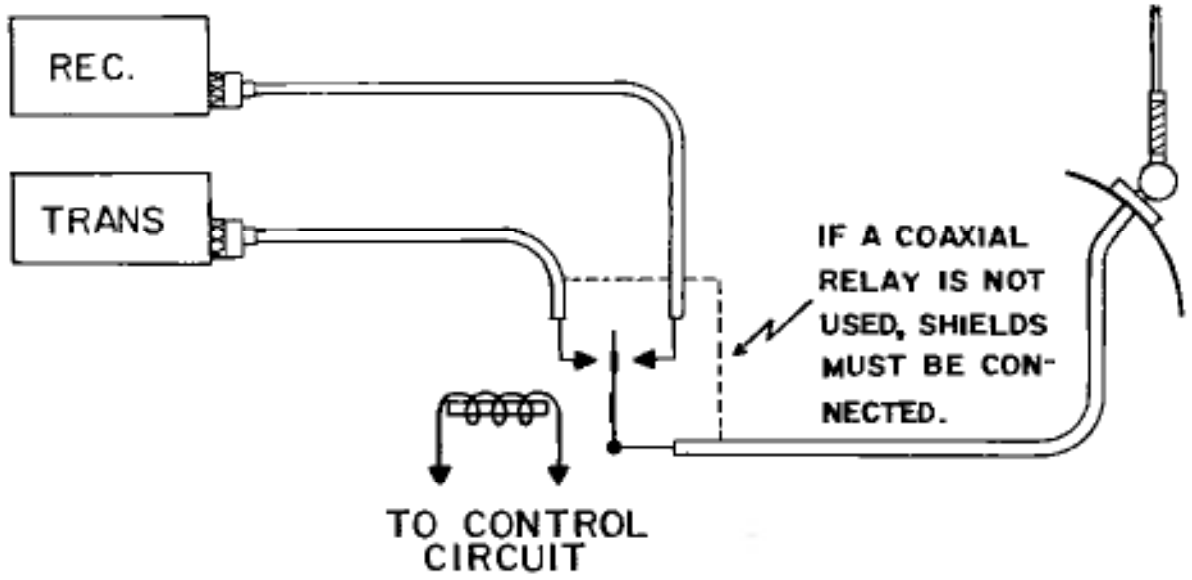


FIG.6 ANTENNA CIRCUIT

SECTION 3

Service and Alignment

3.1 GENERAL. Satisfactory operation of this receiver depends on several external factors. Before removing a receiver which is performing in an unsatisfactory manner, carefully inspect antenna connections, power cables and plugs, the storage battery and connections (if a vehicular installation), and the A.C. power source (if operated in a fixed location), and the speaker connections. It is an aggravating waste of time and effort to remove and attempt to service a receiver when the trouble is an external one.

(a) ANTENNA. If the receiver has its normal noise level, but signals are very weak, look for a broken antenna lead close to the receiver, or for an open or inoperative antenna relay.

(b) CABLES AND PLUGS. The initial installation should locate all cables and plugs where they will not be exposed to physical shock or subjected to twisting and bending.

(c) FUSES. Check fuses with an ohmmeter. A good fuse has no appreciable resistance.

3.2 TUBES. Even though modern methods of production are producing more reliable tubes than ever, the first source of trouble is most likely to be a defective tube. Tube failure will produce weak signals, intermittent operation, noise, or a completely dead receiver. When checking tubes, mark them as they are removed from the receiver so that they may be returned to their original sockets. Where a tube is changed in any circuit, that circuit should be re-aligned for peak performance as outlined in the section on alignment.

New tubes should be tapped while operating to check for microphonics, which will ruin operation of a mobile receiver.

3.3 CIRCUIT FAILURE. Excluding tubes, the most common source of circuit failure will invariably be found in the dozens of resistors and capacitors within the receiver. A defective resistor or capacitor can usually be found by a point-to-point continuity test, although a careful visual inspection will often show the defective part, such as charred resistors. The operating voltage shown on the circuit diagram permits a careful check of operating elements. The check should be made with a D.C. voltmeter of 20,000 ohms per volt sensitivity or a vacuum tube voltmeter. All measurements are taken with the antenna input shorted, switch "G" in the off position and the bandswitch in position "1". All measurements are made using a PSR-117 power supply. (Any supply may be used that will give the same "B" voltage.)

3.4 GENERAL ALIGNMENT INSTRUCTIONS. Thoroughly familiarize yourself with the layout of all of the coils as shown in Figures 7 and 8 before beginning alignment. All of the coils are in cans including the R.F. and I.F. coils with one exception. The broadcast oscillator coil is located under the chassis near the front of the receiver as can be seen in Figures 7 and 8.

Check the dial cord and the pointer to be certain that there is sufficient tension on the cord, and that the pointer rides free of all obstructions. Before alignment, be sure you have an accurate signal generator. If at all possible, crystals that fall near the alignment frequencies specified are preferred for maximum accurecy. The alignment of the receiver can never be more accurate than the signal generator with which it was aligned.

3.5 I.F. AND B.F.O ALIGNMENT. Remove the 6C4 oscillator tube.

Set the R.F. gain control (Control "D2") in its full clockwise position.

Set the B.F.O. Switch (Switch "H") in the off position. Connect the signal generator through a .001 mfd. mica capacitor to the center section of the tuning capacitor.

Connect a vacuum tube voltmeter from the A.V.C. buss to ground. (If your receiver power supply is equipped with an "S" meter, the vacuum tube voltmeter is not necessary.) If an "S" meter is not included and you do not have a vacuum tube voltmeter available, connect a 0 to 10 milliampere

meter in series with the lead coming from pin 6 on the receiver power plug. The MULTI-ELMAC PSR-117 is equipped with an "S" meter and on the MULTI-ELMAC PSR-612 the 0 to 10 milliampere meter may be connected to pin 3 and 4 of the accessory plug with the jumper removed.

With the signal generator set at 2238 kc. adjust all of the I.F. slugs for maximum response. (It should be noted that maximum response is a maximum reading on the "S" meter and a minimum reading on the 0 to 10 milliampere meter.) There are two slugs in T2, T4, and T6 adjustable from the top and bottom of the chassis. In T5, there is only one adjusting slug that can be either reached from the top or bottom of the chassis. A special 3/32 hex screwdriver is necessary for the adjustment of all coils. When adjusting the I.F. coils for maximum response, you should be careful to keep the output from the signal generator low enough to prevent overload of the receiver. When the I.F. stages have been aligned, turn on the B.F.O. (Switch "H"), turn up the injection control (Clockwise rotation of control A-2) and set the B.F.O. pitch control (Control "F") at mid range. Adjust the B.F.O. coil, T8, for zero beat. It will be noted that it is not necessary to adjust the 262 kc. amplifier with 262 kc. output from the signal generator. This is true because the crystal oscillator (2500 kc.) derives 262 kc. automatically from the 2238 kc. signal. (2500-2238 equals 262)

Replace the 6C4 tube.

3.6 **R. F. ALIGNMENT.** Before the R.F. alignment is begun the pointer must be positioned properly in respect to the dial. When the tuning capacitor is completely meshed (closed) the pointer should be aligned with the edge of the black border at the left side of the dial face. If this is not done the receiver may not track properly across the entire tuning range.

Any signal generator used to align this receiver must have a good attenuator. The output from the signal generator should be kept low enough to prevent the "S" meter from reading over S6.

The Bands may be aligned in any order, but for the sake of this manual, we will start with band 1 and align the bands in order.

BAND 1 (10 Meters—28.0 to 29.7 Mc.)

Set the Antenna trimmer in the middle of its range.

Set the Bandswitch on Band 1.

Set the receiver Dial to 29.0 Mc.

Connect a signal generator to the receiver antenna jack and set the generator to 29.0 Mc.

Adjust the 10 Meter oscillator coil until the signal is tuned in properly.

Adjust the 10 Meter Antenna coil and Converter coil for maximum output.

Check the tracking at 28.0 and 29.7 Mc. If the tracking is seriously off at these two points the setting of trimmer C30-10 will have to be changed and the oscillator coil readjusted. Several trials between trimmer setting and coil adjustment may be necessary to achieve proper tracking. NOTE. Oscillator is on the low side of the signal. It will be impossible to make this band track if the oscillator is on the high side.

BAND 2 (15 Meters—21.0 to 21.45 Mc.)

Set the Antenna trimmer in the middle of its range.

Set the Bandswitch on Band 2.

Set the receiver Dial and the signal generator to 21.3 Mc.

Adjust 15 Meter oscillator coil until the signal is tuned in properly.

Adjust the 15 Meter Antenna and Converter coils for maximum output.

Check the tracking at 21.0 and 21.45 Mc. If the tracking is off proceed as for 10 meters above using C30-15 and the 15 meter oscillator adjustment slug. NOTE. Oscillator is on the low side of the signal.

BAND 3 (20 Meters—14.0 to 14.4 Mc.)

Set the Antenna trimmer in the middle of its range.

Set the Bandswitch on Band 3.

Set the receiver Dial and the signal generator to 14.2 Mc.

Adjust the 20 Meter oscillator coil until the signal is tuned in properly.

Adjust the 20 Meter Antenna and Converter coils for maximum output.

Check the tracking at 14.0 and 14.4 Mc. Correct any error in tracking using trimmer C30-20 and the meter oscillator coil adjustment slug. NOTE. The oscillator is on the high side of the signal.

BAND 4 (40 Meters—7.0 to 7.3 Mc.)

Set the Antenna trimmer in the middle of its range.

Set the Bandswitch on Band 4.

Set the receiver Dial and the signal generator to 7.15 Mc.

Adjust the 40 Meter oscillator coil until the signal is tuned in properly.

Adjust the 40 Meter Antenna and Convertor coils for maximum output.

Check the tracking at 7.0 and 7.3 Mc. Correct any error in tracking by using trimmer C30-40 and the 40 meter oscillator coil adjustment slug. Note. The oscillator is on the high side of the signal.

BAND 5 (80 Meters—3.5 to 4.0 Mc.)

Set the Antenna trimmer to where the plates are about one quarter meshed. The antenna coil will not track at any other setting.

Set the Bandswitch on Band 5.

Set the receiver Dial and the signal generator to 3.75 Mc.

Adjust the 80 Meter oscillator coil until the signal is tuned in properly.

Adjust the 80 Meter Antenna and Converter coils for maximum output.

Check the tracking at 3.5 and 4.0 Mc. Correct any error in tracking by using trimmer C30-80 and the 80 meter oscillator coil adjustment slug. NOTE. The oscillator is on the high side of the signal.

BAND 6 (160 Meters—1.8 to 2.0 Mc.)

Set the Antenna trimmer to where the plates are about one quarter meshed.

Set the Bandswitch on Band 6.

Set the receiver Dial and the signal generator to 1.9 Mc.

Adjust the 160 Meter oscillator coil until the signal is tuned in properly.

Adjust the 160 Meter Antenna and Converter coils for maximum output.

Check the tracking at 1.8 and 2.0 Mc. Correct any error in tracking by using trimmer C30-160 and the 160 meter oscillator adjustment slug. NOTE. The oscillator is on the high side of the signal.

BAND 7 (Broadcast .54 to 1.6 Mc.)

Set the Antenna trimmer to where the plates are about one quarter meshed.

Set the Bandswitch on Band 7.

Set the receiver Dial and the signal generator to 1.0 Mc.

Adjust the broadcast oscillator coil until the signal is tuned in properly.

Adjust the broadcast Antenna and Converter coils for maximum output.

Check the tracking at 600 and 1500 Kc. Correct any error in tracking by using trimmer C37 and the broadcast oscillator coil slug.

Set receiver dial and signal generator to 600 Kc. Peak the Broadcast Converter coil at this setting for maximum output.

Set the receiver Dial and signal generator to 1500 Kc. and adjust trimmer C22 for maximum output at this frequency. NOTE. The oscillator is on the high side of the signal on this band and the oscillator frequency is relatively high due to the high first intermediate frequency. The broadcast oscillator tunes from 2.778 to 3.838 Mc.

3.7 "S" METER ADJUSTMENT. Remove antenna and short input jack with a piece of bare wire. Adjust potentiometer R-200 until the "S" meter reads zero under this zero signal condition. The "S" meter should read zero when the receiver is turned off. If not, adjust to zero with panel screw adjustment on the meter. If it becomes necessary to replace the second I.F. amplifier tube, a careful selection of tubes must be made since changes in the electrical characteristics of the tube will change the sensitivity of the "S" meter.

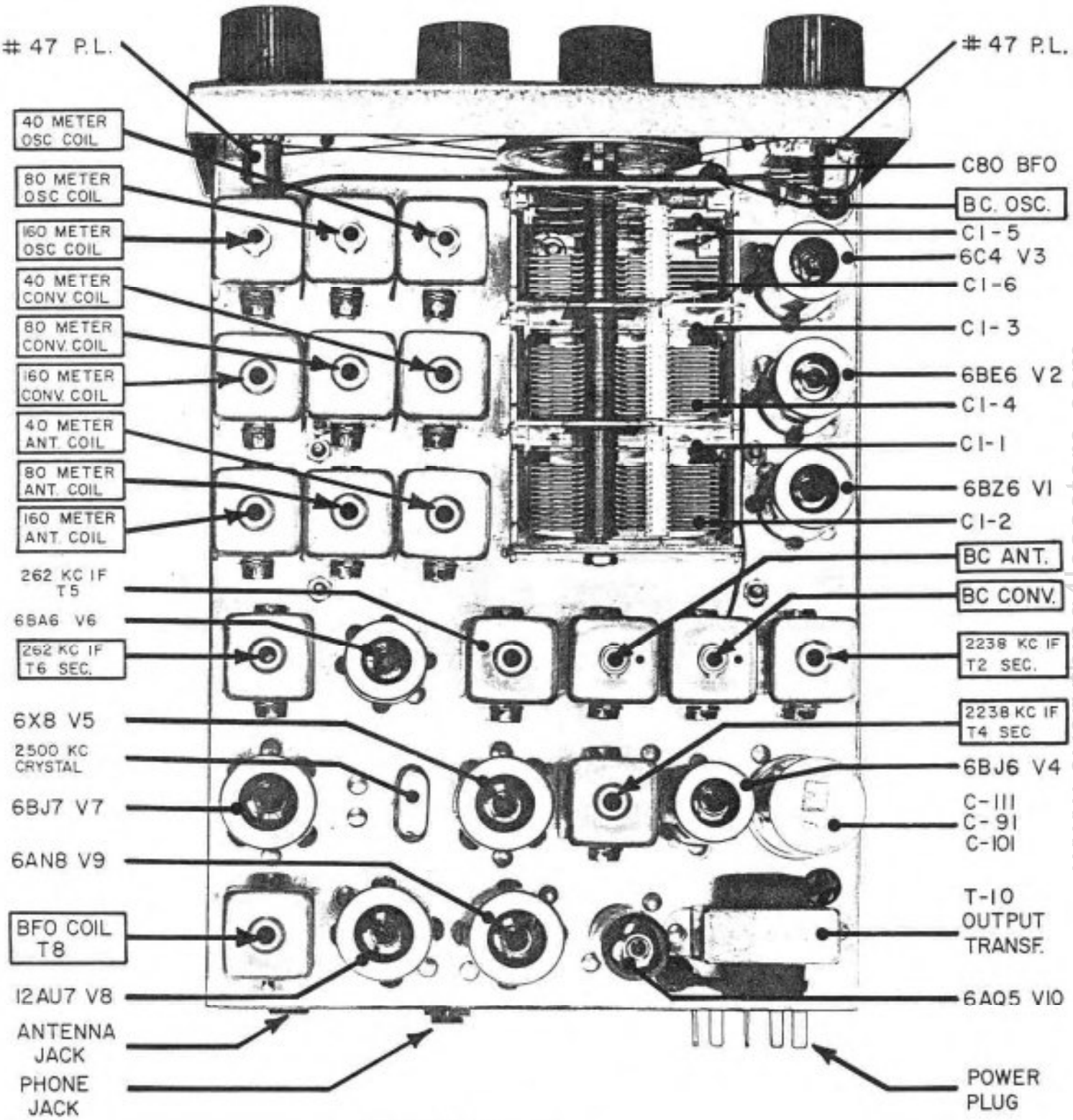


FIGURE – 7.

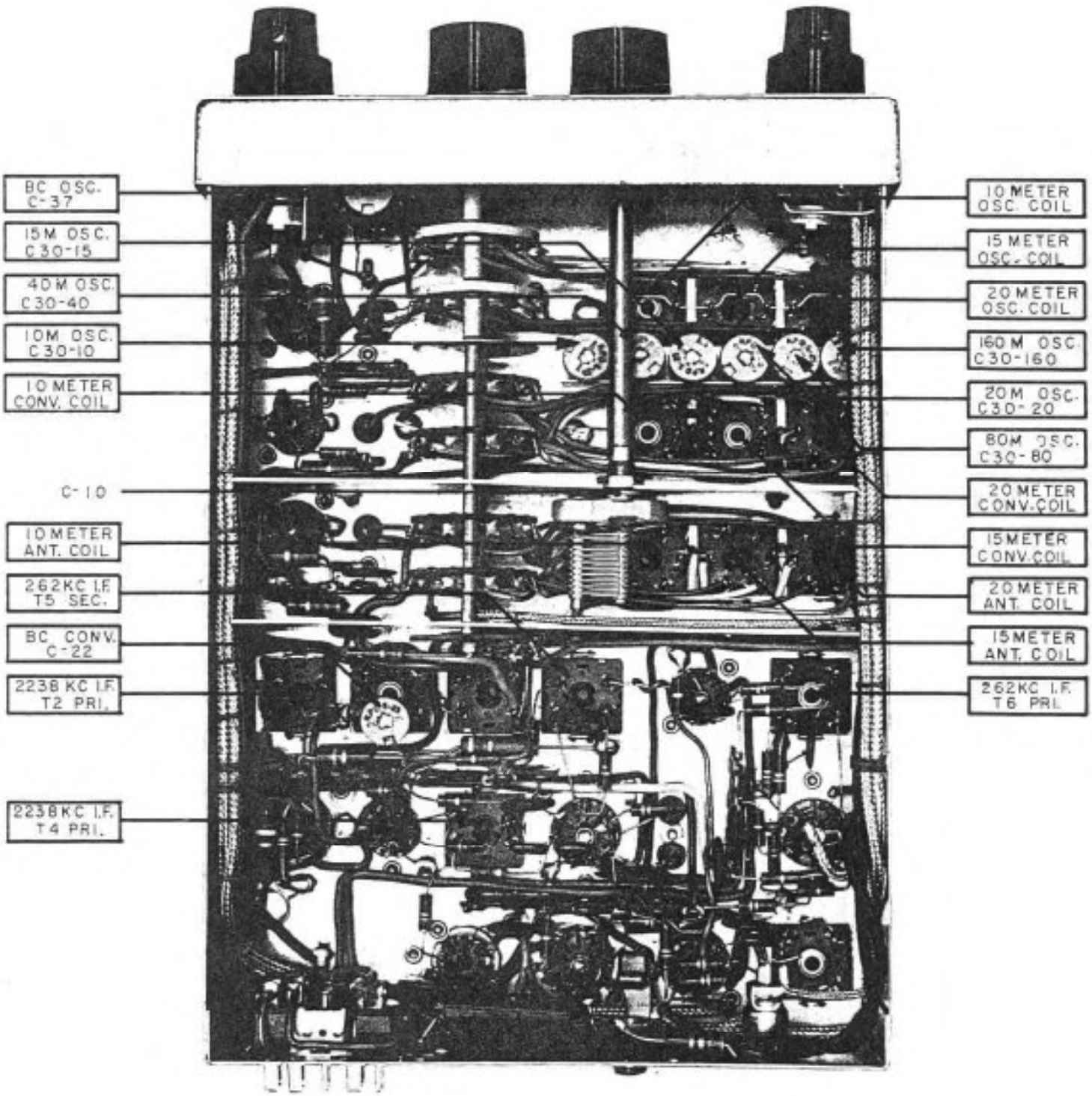


FIGURE-8.

SECTION 4

Appendix

4.1 WARRANTY. This receiver has been carefully tested and was shipped from the factory in perfect operating condition. If the set arrives damaged in transit, it is important that you file claim immediately against the carrier.

THE MULTI-PRODUCTS COMPANY warranting this receiver to be free from defective materials and workmanship, agrees to repair or replace, without charge, any defective part or accessory provided notice of the claimed defect is given the manufacturer within 90 (ninety) days of the date of sale to the original purchaser. Any part returned to the manufacturer shall be shipped prepaid by the owner. Any failure of the equipment following modification by the user, or occurring through application of power supply voltages other than those specified in this instruction manual shall not constitute a defect within this warranty.

This warranty shall not become effective until the Owner's Registration Card supplied with the equipment has been filled out and mailed to the manufacturer. Please fill out and mail this card promptly.

The manufacturer reserves the right to make any changes in the receiver without obligating itself with respect to prior production.

PMR-7 Parts List

4.2

C1-1-2-3-4-5-6	Tuning Capacitor Part #326		
C10	Antenna Trimmer 75 MMF Part #325-1		
C11	.005 MFD Dual Disc Ceramic (Part of C16)		
C12	.005 MFD Disc Ceramic		
C15	.005 MFD Disc Ceramic		
C16	.005 MFD Dual Disc Ceramic (Part of C11)		
C17	.005 MFD Disc Ceramic		
C21	.005 MFD Dual Disc Ceramic (Part of C26)		
C22	5 to 25 MMF Trimmer		
C25	5 MMF Silver Mica		
C26	.005 MFD Dual Disc Ceramic (Part of C21)		
C27	.005 MFD Dual Disc Ceramic (Part of C45)		
C30-10	5 to 25 MMF Trimmer		
C30-15	5 to 25 MMF Trimmer		
C30-20	5 to 25 MMF Trimmer		
C30-40	5 to 25 MMF Trimmer		
C30-80	5 to 25 MMF Trimmer		
C30-160	5 to 25 MMF Trimmer		
C35	75 MMF Silver Mica		
C36	200 MMF Silver Mica		
C37	5 to 25 MMF Trimmer		
C38	56 MMF NPO Tubular Ceramic		
C39	.01 MFD Disc Ceramic		
C41	.005 MFD Dual Disc Ceramic (Part of C46)		
C45	.005 MFD Dual Disc Ceramic (Part of C27)		
C46	.005 MFD Dual Disc Ceramic (Part of C41)		
C47	.005 MFD Dual Disc Ceramic (Part of C56)		
C55	75 MMF Silver Mica		
C56	.005 MFD Dual Disc Ceramic (Part of C47)		
C57	.005 MFD Dual Disc Ceramic (Part of C65)		
C58	2 MMF Silver Mica		
C59	.002 MFD Disc Ceramic		
C61	.005 MFD Dual Disc Ceramic (Part of C66)		
C64	.01 MFD Disc Ceramic		
C65	.005 MFD Dual Disc Ceramic (Part of C57)		
C66	.005 MFD Dual Disc Ceramic (Part of C61)		
C67	.005 MF Disc Ceramic		
C71	250 MMF Tubular Ceramic		
C72	.01 MFD Disc Ceramic		
C73	500 MMF Tubular Ceramic		
C74	.01 MFD Disc Ceramic		
C75	100 MMF Silver Mica		
C76	.01 MFD Disc Ceramic		
C80	24 MMF BFO Pitch Control Part #325-2		
C81	.01 MFD Disc Ceramic		
C82	GIMMICK		
C83	.01 MFD Disc Ceramic		
C85	75 MMF Silver Mica		
C91	20 MFD 350 Volt Electrolytic (Part of C101 & C111)		
C92	.01 MFD Disc Ceramic		
C94	.03 MFD 400 Volt Paper Tubular		
C98	.01 MFD Disc Ceramic		
C99	.01 MFD Disc Ceramic		
C101	20 MFD 25 Volt Electrolytic (Part of C91 & C111)		
C102	.01 MFD Disc Ceramic		
C103	.005 MFD Disc Ceramic, 1000 DCW Volts		
C111	10 MFD 350 Volt Electrolytic (Part of C91 & C101)		
R10	10K Ohm Potentiometer (Part of R92)		
R11	100 Ohm	½ W.	Resistor
R12	68 Ohm	½ W.	Resistor
R13	470 Ohm	½ W.	Resistor
R14	470 Ohm	½ W.	Resistor
R15	100K Ohm	½ W.	Resistor
R16	15K Ohm	1 W.	Resistor
R17	4.7K Ohm	1 W.	Resistor
R21	180 Ohm	½ W.	Resistor

PMR-7 PARTS LIST

R25	100K Ohm	½W.	Resistor
R26	220K Ohm	½W.	Resistor
R27	100K Ohm	1 W.	Resistor
R35	47K Ohm	1 W.	Resistor
R41	1000 Ohm	½W.	Resistor
R42	47K Ohm	½W.	Resistor
R43	10K Ohm	½W.	Resistor
R45	100K Ohm	½W.	Resistor
R46	150K Ohm	½W.	Resistor
R47	1000 Ohm	½W.	Resistor
R55	6.8M Ohm	½W.	Resistor
R56	150K Ohm	½W.	Resistor
R57	47K Ohm	1 W.	Resistor
R58	100K Ohm	½W.	Resistor
R59	150K Ohm	½W.	Resistor
R61	1000 Ohm	½W.	Resistor
R65	100K Ohm	½W.	Resistor
R66	150K Ohm	½W.	Resistor
R67	1000 Ohm	½W.	Resistor
R71	220K Ohm	½W.	Resistor
R72	330K Ohm	½W.	Resistor
R73	3.3M Ohm	½W.	Resistor
R74	1M Ohm	½W.	Resistor
R75	1M Ohm	½W.	Resistor
R76	1.2M Ohm	½W.	Resistor
R77	5.6K Ohm	½W.	Resistor
R78	100K Ohm	1 W.	Resistor
R79	1M Ohm	½W.	Resistor
R81	10K Ohm	Potentiometer	(Part of R90)
R82	100K Ohm	½W.	Resistor
R83	100K Ohm	½W.	Resistor
R84	220K Ohm	½W.	Resistor
R85	100K Ohm	½W.	Resistor
R90	100K Ohm	Potentiometer	(Part of R81)
R91	100K Ohm	½W.	Resistor
R92	500K Ohm	Potentiometer	(Part of R10)
R93	6.8M Ohm	½W.	Resistor
R94	2.2M Ohm	½W.	Resistor
R95	470K Ohm	½W.	Resistor
R96	150K Ohm	½W.	Resistor
R97	2.2M Ohm	½W.	Resistor
R98	1M Ohm	½W.	Resistor
R99	1M Ohm	½W.	Resistor
R101	390 Ohm	1 W.	Resistor
R102	470K Ohm	½W.	Resistor
R103	6.8 Ohm	1 W.	Resistor

SW1	A to G	Bandswitch Part #313
SW2		ON-OFF Switch on R92
SW71		S.P.S.T. Slide Switch (ANL)
SW72		S.P.S.T. Switch on R90 (AVC)
SW81		S.P.S.T. Slide Switch (BFO)

TA-1	40 and 10 Meter Antenna Coil Part #349
TA-2	80 and 15 Meter Antenna Coil Part #346
TA-3	160 and 20 Meter Antenna Coil Part #343
TA-4	Broadcast Antenna Coil Part #341
TC-1	40 and 10 Meter Converter Coil Part #350
TC-2	80 and 15 Meter Converter Coil Part #347
TC-3	160 and 20 Meter Converter Coil Part #344
TC-4	Broadcast Converter Coil Part #342
TO-1	40 and 10 Meter Oscillator Coil Part #351
TO-2	80 and 15 Meter Oscillator Coil Part #348
TO-3	160 and 20 Meter Oscillator Coil Part #345
TO-4	Broadcast Oscillator Coil Part #340
T-2	2238 Kc. I.F. Transformer Part #339
T-4	2238 Kc. I.F. Transformer Part #339
T-5	262 Kc. Input I.F. Transformer #338
T-6	262 Kc. Output I.F. Transformer #337
T-8	262 Kc. Beat Frequency Oscillator Coil Part #336

PMR-7 PARTS LIST

T-10	Output Transformer Part #357
CR50	2500 Kc. Crystal
V1	6BZ6 R.F. Amplifier
V2	6BE6 First Mixer
V3	6C4 H.F. Oscillator
V4	6BJ6 2238 Kc. I.F. Amplifier
V5	6X8 Second Mixer and Oscillator
V6	6BA6 262 Kc. I.F. Amplifier
V7	6BJ7 Second Detector, ANL, and DAVC
V8	12AU7 Beat Frequency Oscillator and Isolation Amplifier
V9	6AN8 First Audio Amplifier and Squelch
V10	6AQ5 Audio Output Amplifier

4.3 PSR-117 PARTS LIST

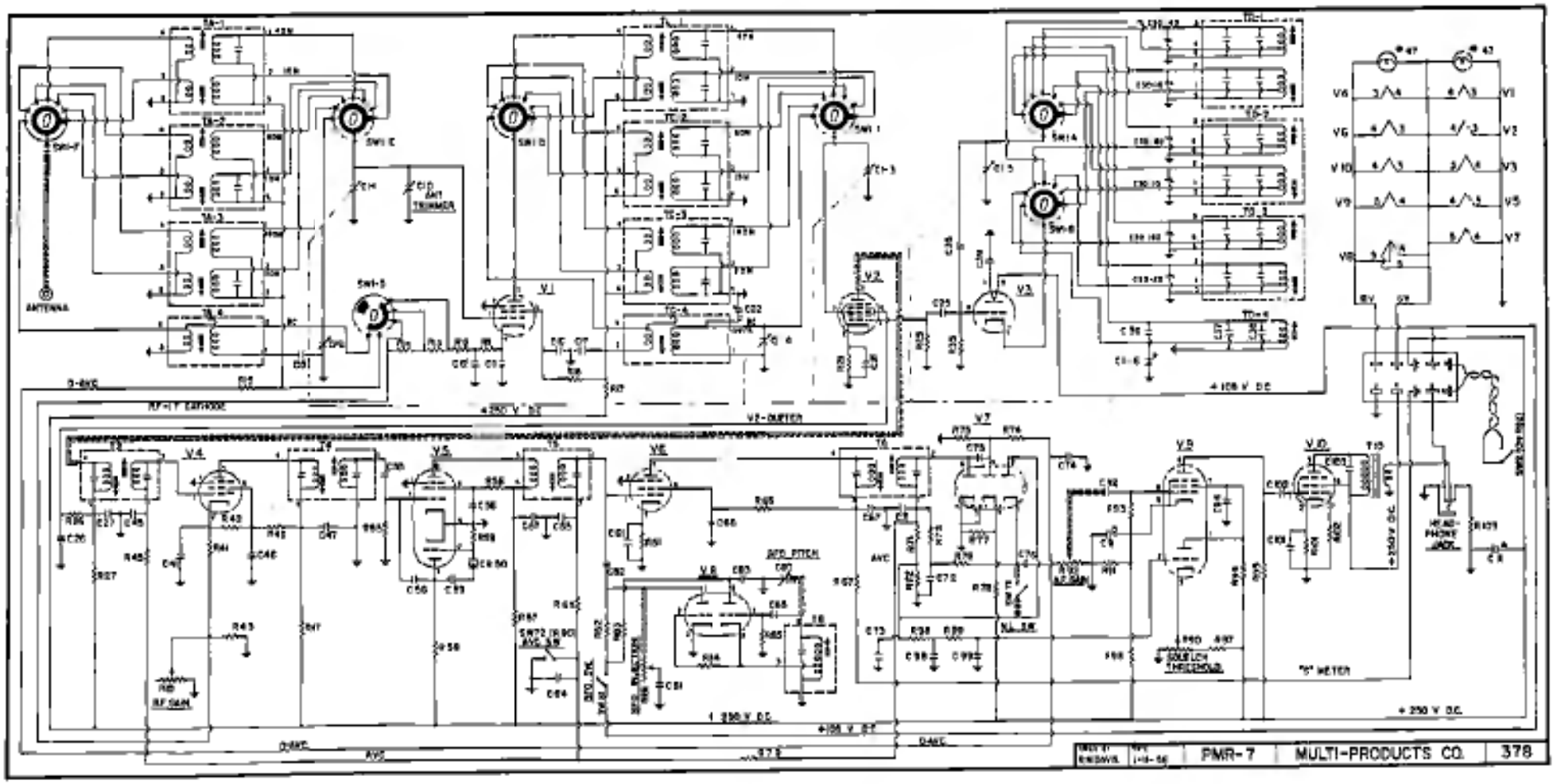
C-201	20 MFD 350 Volt Electrolytic (Part of C-202)
C-202	20 MFD 350 Volt Electrolytic (Part of C-201)
R-200	500 Ohm Potentiometer (S Metar Adjustment)
R-201	47K Ohm 2W. Resistor
R-202	390 Ohm 1W. Resistor
R-203	10K Ohm 10W. Resistor
V-201	6BW4 Rectifier
V-202	OB2 Voltage Regulator
CH-201	8 Henry Filter Choke Part #121C2
F-201	1½ A. Slow Blow Fuse
T-201	Power Transformer Part #121P71

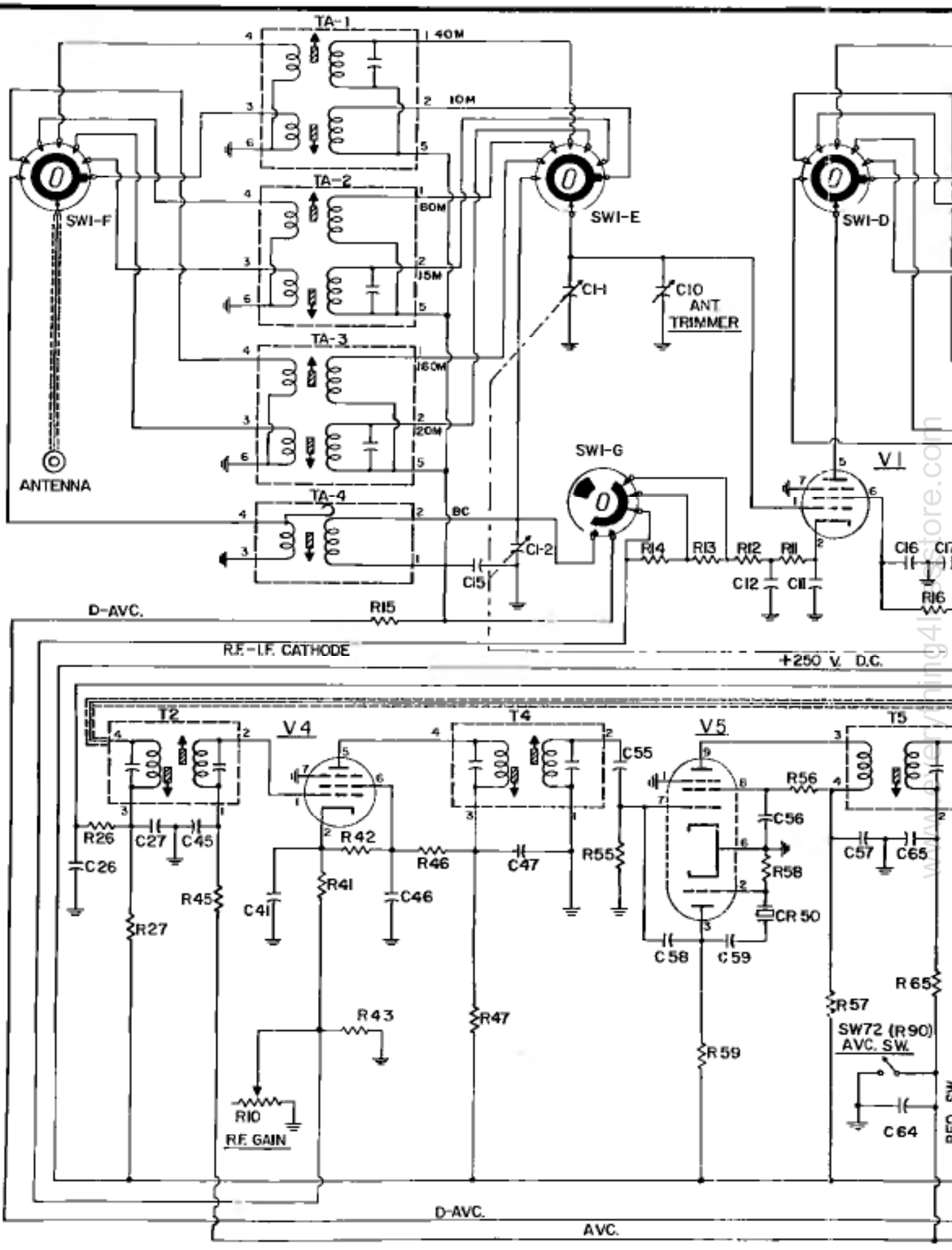
4.4 PSR-612 PARTS LIST

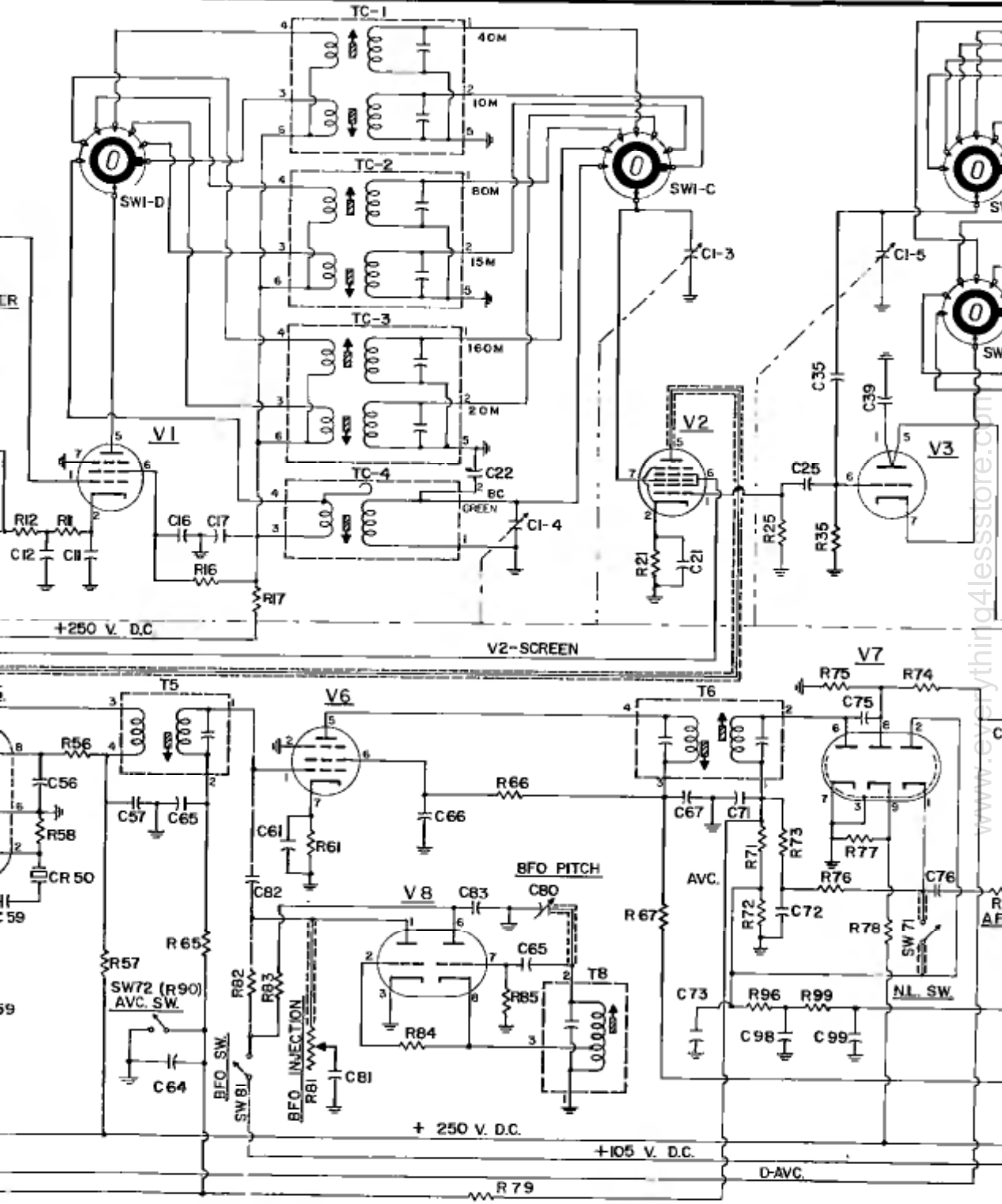
C-301	20 MFD 350 Volt Electrolytic (Part of C-302)
C-302	20 MFD 350 Volt Electrolytic (Part of C-301)
C-303	250 MMF Tubular Ceramic
C-304	.005 MFD 1600 Volt Disc Ceramic
C-305	.5 MFD 120 Volt Hash Capacitor
C-306	.5 MFD 120 Volt Hash Capacitor
C-307	.5 MFD 120 Volt Hash Capacitor
C-308	.01 MFD Disc Ceramic
C-309	.01 MFD Disc Caramic
C-310	.01 MFD Disc Ceramic
C-311	.002 MFD Disc Ceramic
C-312	.002 MFD Disc Ceramic
C-313	.002 MFD Disc Ceramic
R-301	4.7K Ohm 1W. Resistor
R-302	600 Ohm 10W. Resistor
R-303	10K Ohm 10W. Resistor
R-306	15 Ohm 10W. Resistor
F-301	14 A. Fuse
L-301	Hash Choke Fast #3779
L-302	Ferrite Core Hash Choke Part #409
L-303	Ferrite Core Hash Choke Part #409
L-304	Ferrita Core Hash Choke Part #409
T-301	Power Transformer Part #121P45
V-301	6X4 Rectifier
V-302	6X4 Rectifier
V-303	OB2 Voltage Regulator
VB-301	Vibrator Mallory Part #4514 or #1514, James #J-23

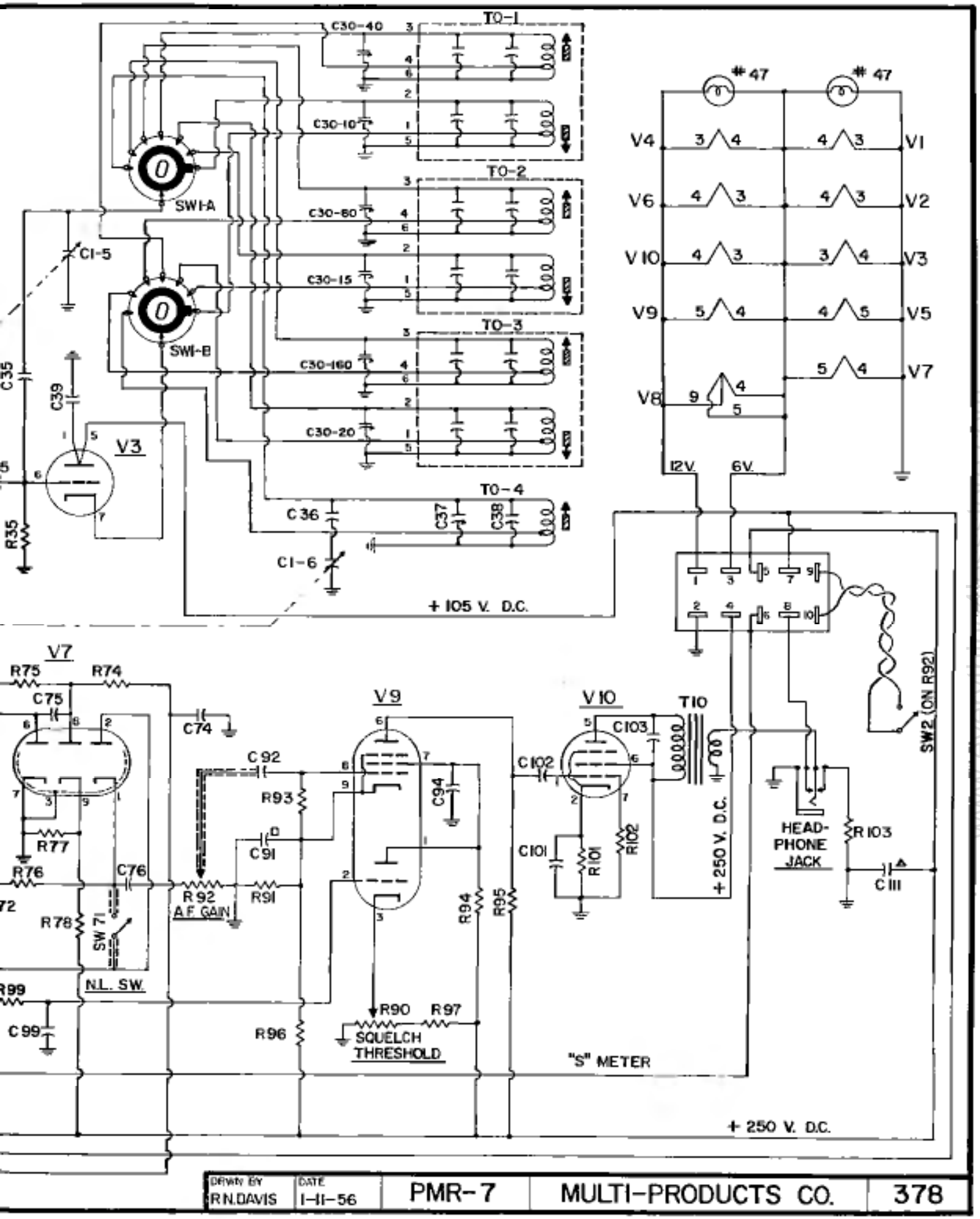
4.5 ESS-3 PARTS LIST

S Meter	0 - 1 MA. D.C. 2" Square Meter
R-200	500 Ohm Potentiometer (S Meter Adjustment)
R-201	47K Ohm 2W. Resistor
R-202	390 Ohm 1W. Resistor

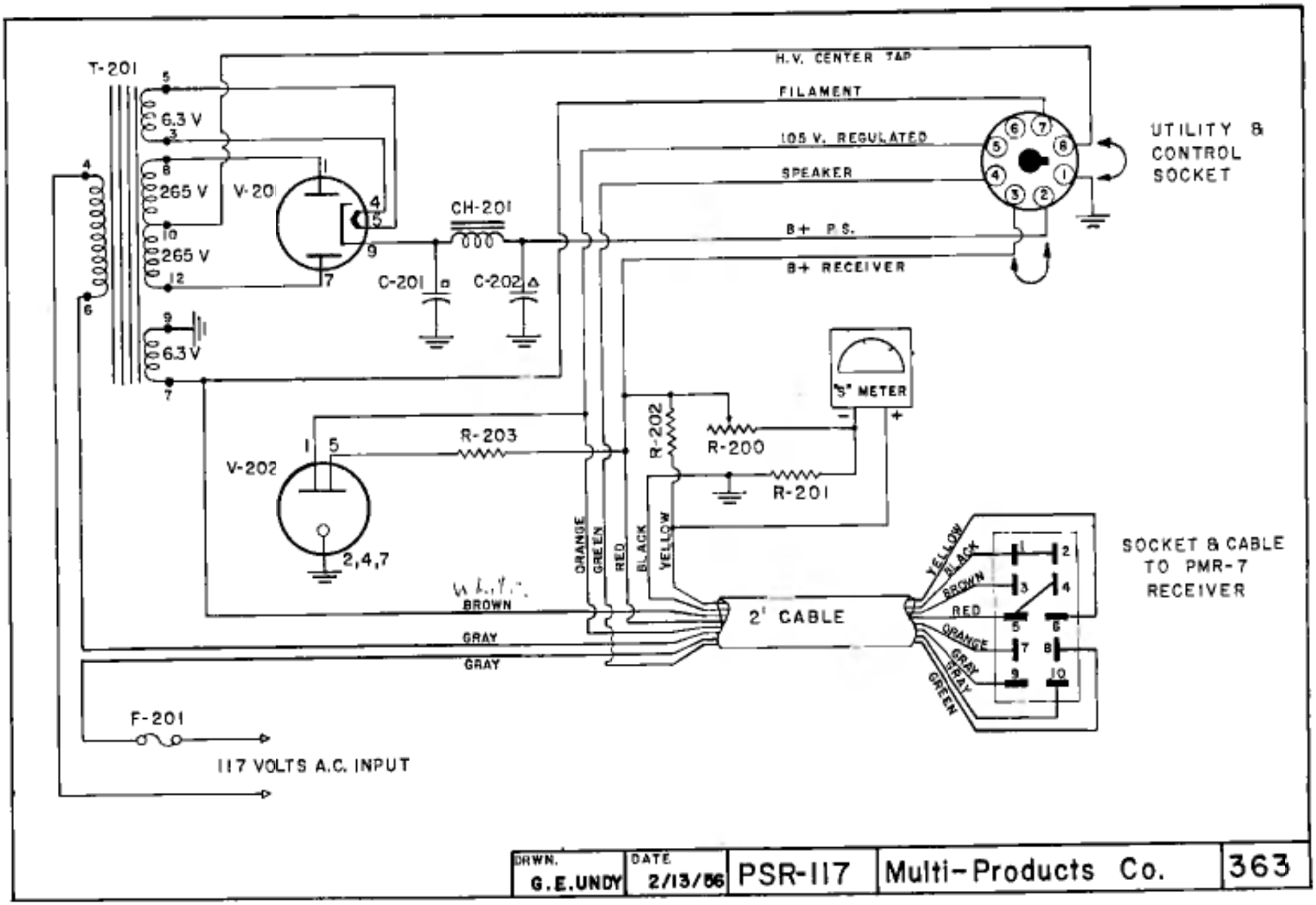








DRWN BY	DATE			
R.N.DAVIS	1-11-56	PMR-7	MULTI-PRODUCTS CO.	378



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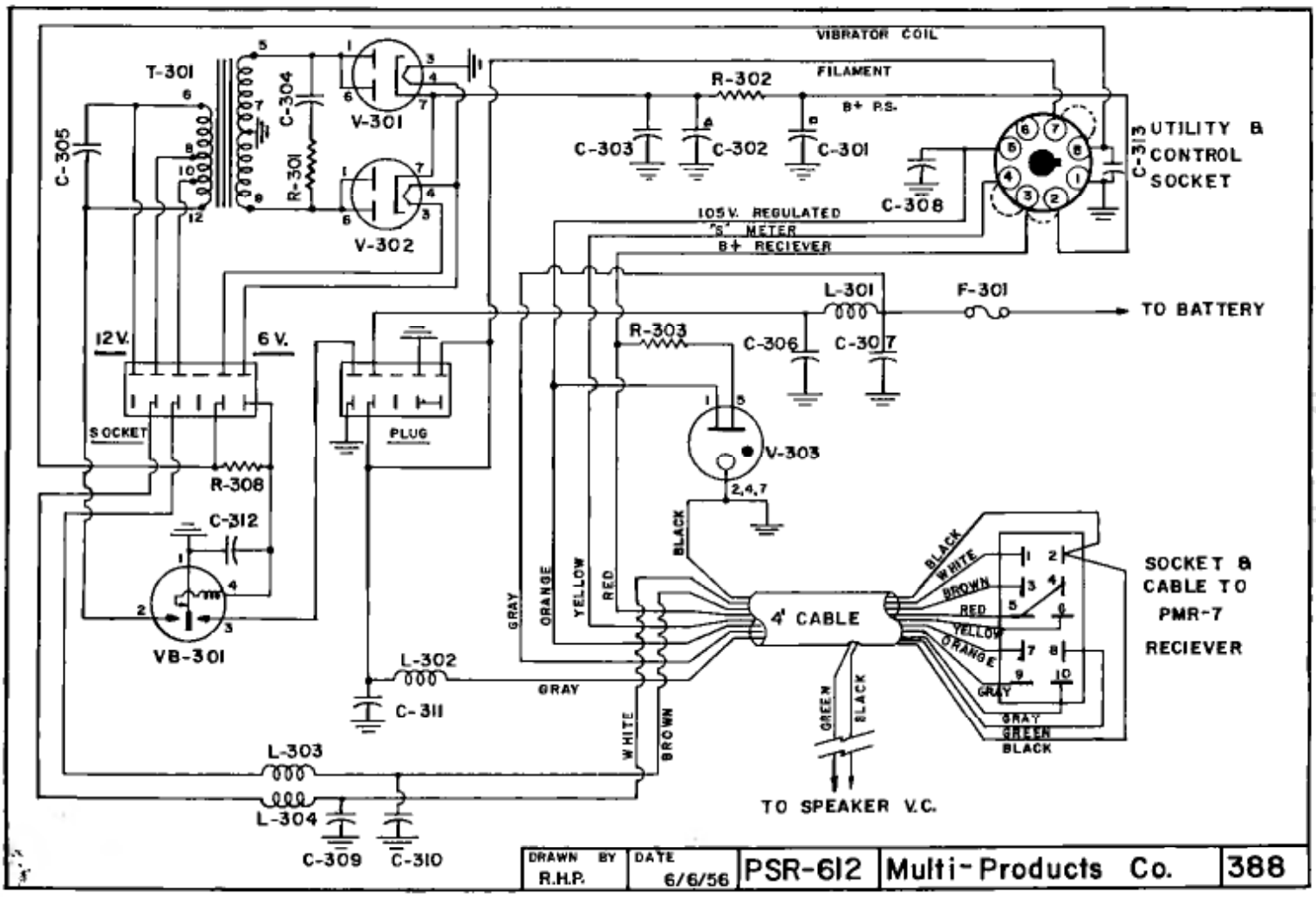
G.E.UNDY	2/13/56	PSR-117	Multi-Products Co. 363



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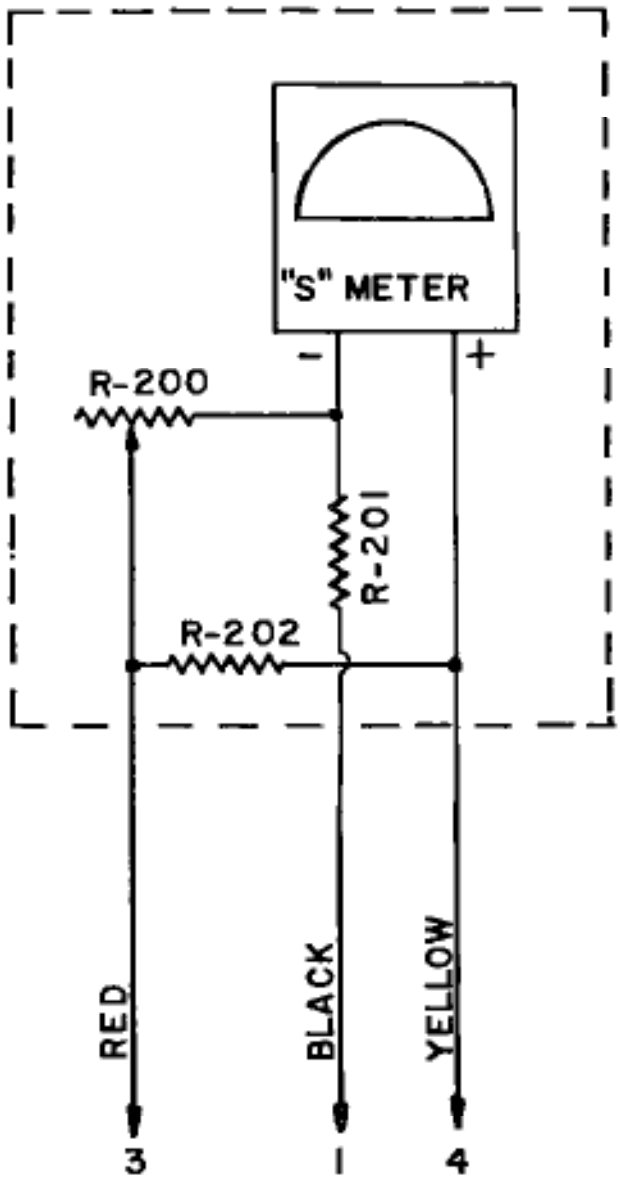
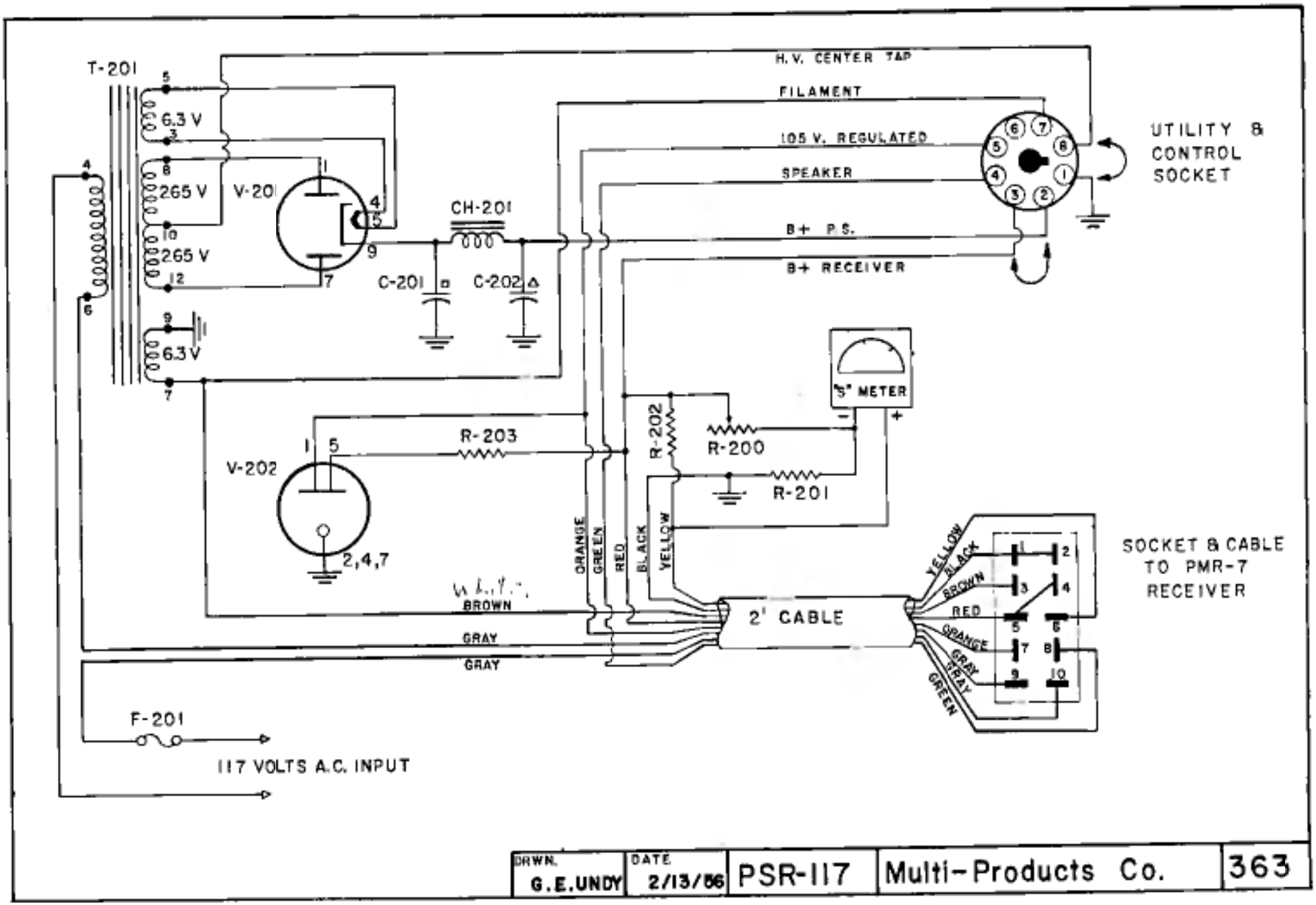


REMOVE JUMPER FROM PINS 3 AND 4 ON UTILITY & CONTROL PLUG AND CONNECT ABOVE NUMBERED WIRES TO CORRESPONDING UTILITY PLUG PIN NUMBERS.

ESS-3 ACCESSORY



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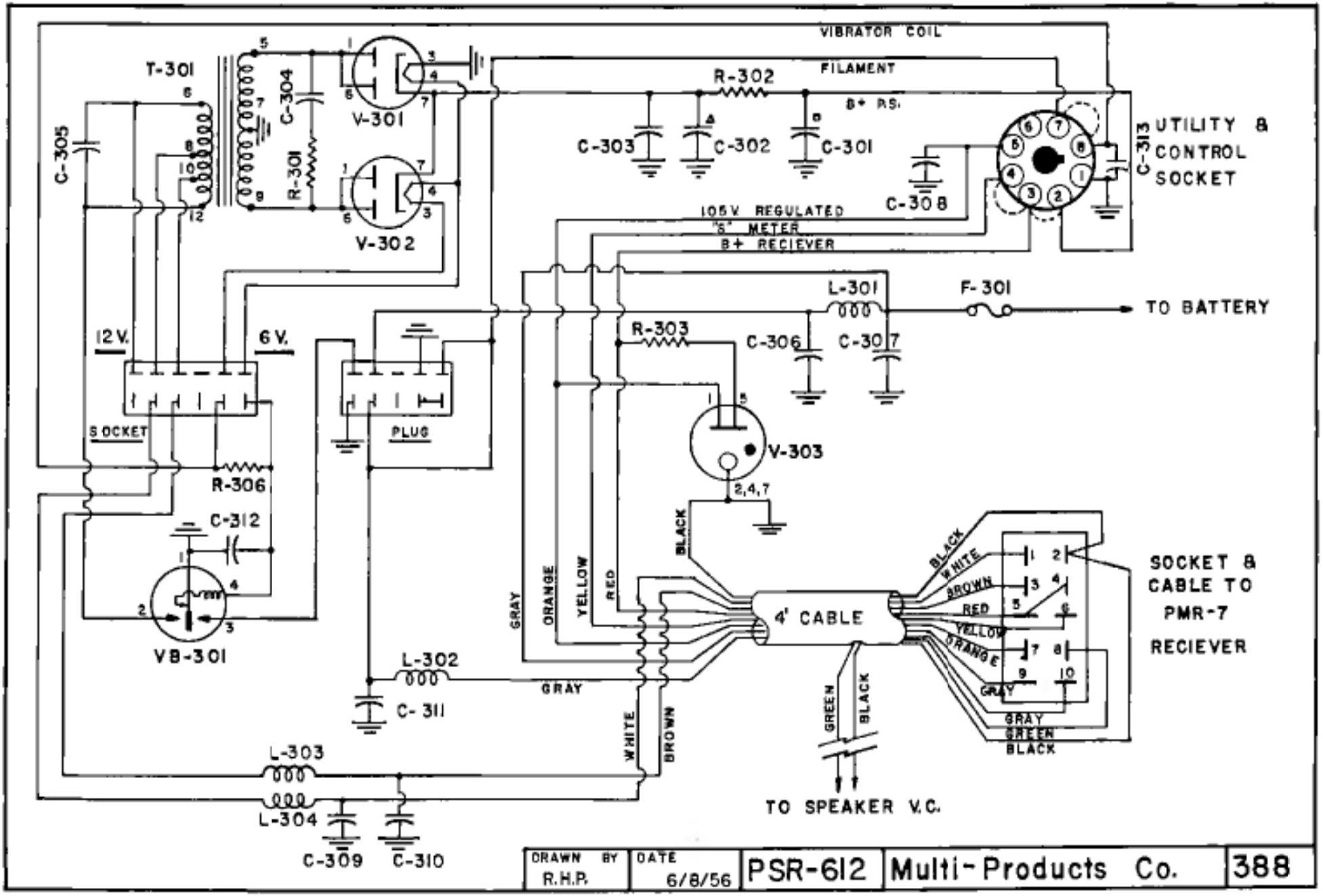
G.E.UNDY	2/13/56	PSR-117	Multi-Products Co.	363



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